Characterization and Prediction of Nutrients and Pesticides in Base Flow Conditions of First-Order Streams in the Mid-Atlantic Coastal Plain: A Collaborative Effort

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The Landscape Indicators for Pesticides Study in Mid-Atlantic Coastal Streams (LIPS-MACS) is a collaboration between the U.S. Environmental Protection Agency's (U.S. EPA) Office of Research and Development and the USGS's National Water Quality Assessment Program. This study capitalized on the strengths of the two agencies to identify background levels of pesticides and nutrients contributed to streams from groundwater (base flow), associated stream biota, and the relative importance of land use, geology, soil types, and landforms in explaining these conditions.

Two major research objectives were defined: (1) estimate the distribution of pesticides and nutrients in the population of headwater streams in the Mid-Atlantic Coastal Plain (MACP) during winter and spring base flow, and (2) develop empirical models using land use, geology, and other geographic variables to predict water quality and aquatic ecology in each coastal plain headwater stream during these conditions. A base network of 174 small (typically first-order) streams was selected across a gradient of hydrogeologic and land use settings from a population of 10,144 first-order streams. Water samples were collected from all 174 streams and analyzed for selected pesticides, pesticide metabolites, nutrients, and major ions. Benthic-community and habitat assessments were also conducted at each stream. A database of landscape metrics computed from soils, land use, and topographic data for each stream's watershed was compiled and analyzed.

We describe the survey design and present the results for two target parameters, total nitrogen and metolachlor plus its degradates. Descriptive statistics and cumulative distribution plots describe the distribution of total nitrogen and metolachlor across the MACP. The distribution information is useful for comparing pesticide and nutrient data from single watersheds to conditions in shallow groundwater and base flow for streams across the MACP. We used logistic regression to analyze the relationship between water chemistry and our suite of landscape metrics. We were able to predict the presence of metolachlor at levels above 0.06 µg/L with an 87% concordance and the presence of total nitrogen at levels above 0.71 mg/L with a 79% concordance. From the models that we developed and a compilation of landscape metrics across

the entire region, we present probability and error estimate maps for predicting metolachlor and total nitrogen at the above levels for 9,150 first order-watersheds in the region. These models will enable managers to compare watersheds and make preliminary decisions about where to allocate resources for additional monitoring or remediation.

Although this work was reviewed by the U.S. Environmental Protection Agency and approved for publication, it may not necessarily reflect official Agency policy.